NATURE

A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE

" To the solid ground
Of Nature trusts the mind which builds for aye."—WORDSWORTH

THURSDAY, NOVEMBER 5, 1885

HYDROPHOBIA

Ὑδροφοβίαν Græci appellant: miserrimum genus morbi.

ONCE more M. Pasteur is attracting the attention of the civilised world by his brilliant investigations. The disease which he hopes to prevent and ultimately to erase from the records of human misery is happily rare, but those who have watched it know that it is one of the most terrible in its effects, and that it is incurable by any means at present known. So strange are its symptoms and its course, that it has been asserted to be no real malady but a mere result of fright and superstition.[1] But of its reality there is unhappily no room for serious question.

It never arises of itself. Like small-pox and syphilis, it is always the result of contagion, and the method and conditions of its transference from rabid dogs or other animals to man are well known. Hitherto the only chance, when a human being has been bitten by a mad dog, has been to remove or isolate or destroy the virus by suction, or ligature, or cautery. And it has been doubted whether these methods are really successful even when the disease does not manifest itself afterwards. For there is often reasonable doubt as to the nature of the disease in the biter. All vicious dogs are not "mad," and all mad dogs are not truly rabid. And when, as often happens, the dog has been at once destroyed, it is impossible to supply deficiencies of previous observation. Moreover, when bitten by a rabid dog, the sufferer may yet escape, for the teeth may only have grazed the skin, and not penetrated to the living tissues beneath, or the poisonous saliva may have been mechanically wiped off by the clothing which the teeth have pierced. As with the venom of snakes, so with the saliva of rabid dogs: it is not enough for it to be spread over the skin, for that will not absorb it, nor even to be swallowed and taken into the stomach, for there, as physiologists say, it is still "outside the body," and, before it can be absorbed, undergoes such changes by the process of digestion, as kill the germs or decompose the chemical compound. The virus must be introduced into the living tissues before it can be carried over the whole body by the channels of the lymph and blood, and reach the central nervous system, on which it exerts its characteristic poisonous action. But, when once so introduced, there is every reason to believe that the terrible effects are constant and uniform. The state of the receiver of the venom at the time may probably modify the rapidity of absorption, as is the case with stimulants and with poisonous drugs; but so far as we know there is no power in the most healthy organism by which the subtle venom, once absorbed, can be neutralised or thrown out. The methods above mentioned[1]—suction by the mouth or by cupping glasses, ligature, and caustics or the actual cautery—all aim at getting the poison out before it has been absorbed. Often they come too late, often they are impracticable or ineffectual from the first. However long the time of "incubation" may be, the interval between the reception of the virus and its spread over the body, no method of preventing the terrible result is known. The length of incubation is far longer than it is in the case of small-pox, of cow-pox, of syphilis, and other known contagions. In two-thirds of the cases collected by Prof. Bollinger, of Munich, the interval of incubation was under two months; and probably it never extends to so long a period as was formerly supposed. The length of this period makes it almost certain that we have to do, not with a mere chemical compound, as in the case of subcutaneous injection of morphia, and probably of the cobra-poison, but with a "particulate contagium," like that of small-pox and chicken-pox, with a living and growing organism, like those of relapsing fever and of anthrax.

Whatever the conclusions to which pathologists will at last be led on these points, the important fact remains that there is an interval of days or months in which the latent plague, established in the patient's body, but not yet ripe for mischief, may be attacked.

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[1] So, in the last century, Sir Isaac Pennington, Regius Professor of Physic at Cambridge, and in recent times Prof. Mashka, of Prague.

[1] These are what were known to the ancients:—"Si rabiosus canis est, cucurbitulâ virus ejus extrahendum est. Deinde . . . vulnus adurendum est." Celsus de Medicinâ, lib. v. cap. xxvii. § 2.

Experience has shown that it cannot be mechanically removed by any surgical operation, nor chemically neutralised or destroyed by any drug. The only promising path of investigation is to seek for some method of forestalling the action of the virus by rendering the organism unfit for its action, as patriots have ravaged their fields and burnt their towns to save their country from an invading army.

By this method Jenner robbed small-pox of most of its terror and almost all its danger, so that where Jennerian vaccination is thoroughly carried out, as in the German army and in Ireland, small-pox is practically extinct.

Pasteur's method of dealing with hydrophobia is avowedly based on the practice of vaccination ; but it is not the mere introduction of the poison in a way that makes its effects less dangerous, like the inoculation of small-pox practised in the last century. Nor is it exactly analogous to Jenner's vaccination, although that term is appropriated by Pasteur himself. For in vaccination an allied disease (or possibly small-pox itself, greatly modified by long transmission through other organisms) is inoculated. In either case the course and symptoms of cow-pox are distinct from those of the more serious disease against which it protects. But in the case of hydrophobia, as in that of "chicken-plague" and anthrax, the poison of the same disease is transmitted through a succession of "bearers" until it is so modified that it may be safely inoculated, and thus the altered virus protects from that which is unmodified.

The "bearers" chosen for these experiments were rabbits. The test of the result was made, not upon human beings but upon dogs, for M. Pasteur is a philanthropist first and a zoophilist after. Fifty dogs were inoculated with modified virus obtained from the bodies [1] of rabbits which had themselves been affected with rabies by inoculation. Would a dog thus inoculated show the ordinary symptoms of the disease? Would it, if bitten by a rabid dog, or designedly inoculated with the unmodified venom of rabies, be protected? Would it, if infected with the modified virus after such direct inoculation, still be safe from its effects? The results have, so far, proved the affirmative to each of these questions. None of the "vaccinated" dogs showed signs of the dreaded disease.

Then came two cases of human beings bitten by mad dogs who were sent up to M. Pasteur in Paris from their homes in Alsace. One of them, a grocer named Vone (? Wohn), had escaped without rupture of the skin, and was sent home with the comfortable assurance that he had never been infected with the disease. The other, a boy of nine years old, had been terribly worried on the 4th of last July ; not only bitten in parts covered by his clothes but also on the hands. He was rescued covered with foam, and bleeding from no less than fourteen wounds. There was no question that the dog was mad, and in all human probability this child, Joseph Meister, was doomed to a certain and horrible death. Such was the opinion of the eminent pathologist, M. Vulpian, and he was supported in this judgment by Dr. Grancher.

Under these circumstances M. Pasteur felt himself justified in applying the means to this suffering fellow-creature, which had already proved efficacious in the case of brutes.[1]

The inoculations were made with a subcutaneous needle, began on the 7th, and were concluded on the 16th of July. "Control experiments" were made with the same injections upon rabbits, and proved that the virus was active. Moreover, since the effects of the modified virus, when introduced into an unprotected animal, are rapid and severe, and its period of incubation extremely short, the result of the attempt to rescue the child from a horrible death would soon be apparent. If he had died of hydrophobia, it would probably have been within a month. If he survived this period there was every reason to hope that he would be as much protected against its future manifestation as the dogs which had been tested before.

Joseph Meister was in perfect health at the end of August, at the end of September, and at the end of October. M. Pasteur believes that he is safe from hydrophobia for the rest of his life.

If similar cases should be followed by similar results, medical science has for the first time a method of combating a frightful and incurable disease.[2] But beyond this, by inoculating dogs, as infants should be vaccinated, they will be rendered insusceptible to rabies. Any mad dog will be destroyed, and the dogs he has bitten will escape. Thus the disease may, it is hoped, be extirpated altogether.

These, however, are but hopes ; at present the whole question is *sub judice*. Other competent observers must repeat the experiments, and every result must be submitted to searching criticism. This is no slight on M. Pasteur, it is only worthy respect to his genius and his skill. For the credentials of the champion who has undertaken the task of ridding the world of this horrible plague of hydrophobia are well known.

M. Louis Pasteur won his spurs as a chemist. It was his discovery of remarkable forms of crystallisation of racemic acid which first made his name known, and which gave M. Renan the opportunity for the exquisite raillery with which the man of letters welcomed the man of science to the Academy.

In dealing with the disease of silk-worms in the south of France, Pasteur first handled a physiological problem, and his thoroughness of research, fertility of resource, and felicity in experiments ended in the best result—practical success as the result of strictly scientific investigation.

Pasteur subsequently investigated the so-called cholera of domestic fowls, and by the method of "attenuated" inoculation has succeeded in protecting them from a destructive epidemic.

His far larger and more important work on the prevention of splenic fever (*charbon* or *anthrax*), the most destructive plague among cattle, has had important and useful results. It has in all probability saved countless multitudes of sheep and oxen in France. In Algeria the results were less satisfactory, and also in Hungary. On the other hand Dr. Roy found the method valuable in La

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[1] Not the marrow, as the *Times* states, but the spinal cord, *moelle épinière*.

[1] "La mort de cet enfant paraissant inévitable, je me décidai, non sans de vives et cruelles inquiétudes, on doit bien le penser, à tenter sur Joseph Meister, la méthode qui m'avait constamment réussi chez les chiens" (*Comptes Rendus* de l'Académie des Sciences, October 26, 1885).

[2] One other patient, a shepherd boy, who was bitten while gallantly attacking a rabid dog, has been inoculated, and the result is to be seen.

Plata. The results of Pasteur's experiments on "pig-typhoid" have also been criticised, and not without reason, by Prof. Klein. It is foolish for newspaper correspondents to attribute hesitation in accepting scientific results to jealousy. Much scrutiny will be necessary. Adverse criticism will be welcomed. M. Pasteur's fame stands in no need of artificial protection.

His past achievements are great: his last attempt was prudent in conception, and carried out with untiring zeal and admirable care. It deserves to succeed. If so, he will again receive the applause of the civilised world; if not, he will have the sympathy and respect of every pathologist.

It is melancholy to reflect that it would be practically impossible for any duly qualified man in England to repeat, to confirm, or to correct his results. We must wait till a wiser and more humane public opinion repeals the present restrictions upon investigations like Pasteur's.

TOPINARD'S "GENERAL ANTHROPOLOGY"

Éléments d'Anthropologie générale. Par le Dr. Paul Topinard. (Paris: A. Delahaye et É. Lecrosnier, 1885.)

THE study of anthropology has been pursued, especially of late years, with great zeal by many leading *savants*, both in the Old and New World, and many valuable contributions to our knowledge have been made in all departments included under its extensive range. This is more particularly the case with respect to that part of the subject which deals with the anatomical characters of the human body. Until this branch of anthropology was so vigorously and successfully studied by Broca, complete ignorance of many fundamental questions prevailed. The direct result of the work of that great anthropologist was immense, while the indirect result due to the incentive which he gave to the study of anthropology generally cannot be over-estimated, but may be inferred from the numerous societies devoted to its study which have rapidly sprung up in various countries. Broca must be considered the great pioneer of modern anthropology, but his untimely death left his work by no means complete, and many extensive fields remained almost untrodden by the foot of the investigator. By the accumulated observations of his followers these deficiencies have been in great part made good, and the time had arrived when it was possible to form generalisations from sufficient data, and when a comprehensive work embracing the whole subject was urgently needed. For the production of such a work no one more highly fitted could be found than Prof. Paul Topinard, trained at the feet of the great master himself, possessed of an extensive knowledge of his subject, and intimately acquainted, by personal visits to the chief centres of anthropological research, with the methods employed by his contemporaries.

The volume before us deals with the elements of general anthropology, and is the first part of Prof. Topinard's contemplated work, which, when completed, will consist of three parts, the second and third parts being devoted to special anthropology and a general survey of the whole subject, concluding with man's place in time, his origin and future.

Prof. Topinard begins by giving an historical account of the origin and development of anthropology, and claims that it is not a new science developed during the latter half of the present century, but that it has, during the last twenty years, attained its adult age and gained its independence.

He divides its history into different periods: (1) from antiquity till the year 1230, the date of the birth of human anatomy; (2) from 1230-1800, when anthropology asserted itself under the influence of Buffon, Blumenbach, Sœmmering, and White; (3) from 1800-1860, during which time three important events occurred that materially assisted its development—viz. the founding of the Society of Anthropology of Paris, the demonstration of the high antiquity of man, and the promulgation of the doctrine of evolution by Darwin. To these a 4th and more recent period is added—viz. that during which Broca's personal influence, aided by the advance of natural sciences, gave great impulse to anthropology. Each of these periods is considered in detail, and many matters of much interest are discussed.

Chapters VII. and VIII. are devoted to generalities including under this a definition of anthropology, its object and the subjects which it embraces. Anthropology is defined as the branch of natural history which treats of man and of the human race. It includes two distinct departments of study—viz. anthropology proper and ethnography; the former treating of the human species and its varieties or races from a purely animal aspect, and therefore essentially anatomical and physiological in its nature; the latter dealing with people and intimately connected with sociology. For the study of anthropology proper, anatomical and zoological knowledge is essential; but such knowledge is not necessary for the study of ethnography, as questions of race are excluded from it. Having discussed the various essential and accessory anthropological sciences, the place of anthropology in science, the meaning of the terms, "characters," "types," "races," "people," "nationalities," &c., he proceeds in the ninth chapter to consider general methods of anthropological research. The different kinds of physical characters and their study are first discussed. These are of three kinds—morphological and anatomical, descriptive and anthropometrical, and finally zoological and anthropological. After a few remarks on anthropometry, and on the comparison of measurement on the skeleton and on the living, which are stated to be not generally directly comparable, an observation which entirely agrees with our own experience, the subject of craniology is discussed, the various points on the skull to which it has been found convenient to give technical names are defined, and derivations and meanings of various terms such as "brachycephalic," &c., applied to skulls to express their form, are explained. In discussing the merits of instruments for measuring the skull, their simplicity is insisted upon. The elaborate instruments used in Germany, and by those who follow the German school (of which happily there are few) are very justly condemned. Broca's *compas d'épaisseur* and the *compas glissière* are figured and recommended. These are certainly simple, but, after considerable experience in their use, we rather take exception to the former, as not being very exact, on account of the measurements being read off on a scale reduced to one-half the actual